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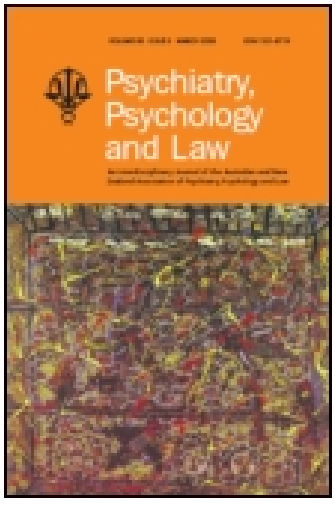

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Psychopathic Personality Traits and Iowa Gambling Task Performance in Incarcerated Offenders

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There is a paucity of research on how psychopathy relates to decision-making. In this study, we assessed the relationship between affective decision-making and psychopathic personality. A sample of prisoners ($n = 49$) was characterized in terms of psychopathic traits using the Psychopathic Checklist: Screening Version (PCL:SV). Decision-making was assessed using the Iowa Gambling Task (IGT). Higher levels of psychopathy related to more advantageous choices ($p = .003$). Also counter-intuitively, higher levels of antisocial traits (facet 4) predicted advantageous choices during the learning phase of the task ($p = .004$). Our findings suggest that some psychopathic facets may be more relevant to decision-making under risk, and highlight the importance of further investigations considering facet and trait-level relationships with decision-making.

Key words: cognition; decision-making; executive function; learning; personality disorder/antisocial personality disorder; prisoners.

Psychopathy is a personality disorder defined by a constellation of behavioural, interpersonal and affective characteristics (Hare, 1998). Behaviourally, psychopaths are characterized by impulsivity, risk-taking, sensation-seeking and antisocial behaviour. Affectively, they have shallow affect and display callous unemotional traits. Interpersonally, they are grandiose, egocentric and manipulative. The construct of psychopathy has been operationalized in the 20-item Psychopathy Checklist-Revised (PCLR; Hare, 1991), which has four facets (fct1–Interpersonal, fct2–Affective, fct3–Lifestyle and fct4–Antisocial). In turn, these facets load onto two higher order factors: Factor 1 (Affective/Interpersonal) and Factor 2 (Lifestyle/Antisocial) (Hare & Neumann, 2008). Given the contribution of decision-making on behaviour, studies of decision-making in psychopathy are likely to provide much needed insights into some of these troublesome characteristics.

Several psychological models have been developed to account for the behavioural characteristics of psychopaths. One theoretical framework that attempts to integrate affective, information-processing and motivational factors relevant to understanding psychopathy is the somatic marker hypothesis (Damasio, 1994). According to the somatic marker hypothesis, beginning early in life positive and negative socialization experiences are translated into bioregulatory signals (somatic markers). Once formed, these signals implicitly guide behaviour, including decision-making, by influencing responsivity

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to positive or negative experiences. The model, initially developed as a theory of emotional decision-making, has suggested that in psychopathy there is impairment in the development or use of somatic markers to guide behaviour (Bechara & Damasio, 2005).

Initial work on the somatic marker hypothesis was based on findings from the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Andersen, 1994) in patients with lesions in the ventromedial (VM) frontal lobes. Such patients make poor decisions on the IGT, and demonstrate alterations in psychophysical reactivity in response to positive and negative outcomes. Bechara (2004) interpreted this impaired decision-making as an inability to use somatic markers to bias decisions toward the most positive outcomes. Given the similarities in presentation between VM patients and those with psychopathy in terms of impulsive, antisocial behaviour, low empathy and failure to learn from experience, the IGT may be a useful probe of the somatic marker model in psychopathic samples (Damasio, 1994).

The IGT is a laboratory-based decision-making task that has been used widely in a range of clinical populations (Brand, Grabenhorst, Starcke, Vandekerckhove, & Markowitsch, 2007; Martin et al., 2004; Sevy et al., 2007; Verdejo-Garcia et al., 2007). For the IGT, participants make a series of selections from four decks of cards with the aim to maximize their pay-offs. Card selections lead to monetary gains (real or hypothetical), but also intermittent losses of varying values. Outcomes associated with the decks are unknown in advance, and the best decks to maximize pay-offs must be deduced through experiences of winning and losing on a card-by-card basis. This design results in a complex scenario of rewards and punishments, and both immediate and longer term outcomes. In doing so, the IGT replicates elements involved in real-life decisions, such as learning, memory, motivation and reward seeking. As such, the IGT may be a useful tool for developing broad theoretical models of decision-making in psychopathy.

To date, the IGT has yielded mixed findings in psychopathy. Viewing psychopathy as a single construct (rather than examining its subcomponents), three studies using PCLR-based assessments found that psychopathic individuals made less-advantageous choices than non-psychopathic individuals (Blair, Colledge, & Mitchell, 2001; Boulanger, Habib, & LanÁon, 2008; Mitchell, Colledge, Leonard, & Blair, 2002). Three other studies, however, did not find performance differences related to whether or not individuals were psychopathic (Blair & Cipolotti, 2000; Losel & Schmucker, 2004; Schmitt, Brinkley, & Newman, 1999). The inconsistencies across these studies may be attributable to any of several factors, such as differences in the nature of the samples (e.g., whether they were clinical or subclinical), whether attention or anxiety were taken into account, sample size and differences in task administration (e.g. whether real or hypothetical incentives were used).

Thus far, only two studies have been published (Losel & Schmucker, 2004; Schmitt et al., 1999) that have examined the IGT in association with psychopathy at the factor level. Given that psychopathy is a multifaceted construct with underlying dimensions that logically could be related in different ways to decision-making and risk-taking, it seems likely that studies taking into account the underlying dimensions of psychopathy would be useful. Interestingly, neither the Losel and Schmucker (2004) nor the Schmitt et al., (1999) study found significant associations between psychopathy factors and IGT performance. Furthermore, no study reported to date has examined psychopathy facet- or trait-level relationships with IGT performance. This is an important avenue of research because it may provide greater insights into which, if any, aspects of the psychopathy construct are associated with impaired decision-making on the IGT.

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In this study, we examined: (1) whether psychopathic traits relate differentially to IGT performance; (2) whether cognitive processes underlying IGT performance, such as learning and reward sensitivity, vary depending on level of psychopathy; and (3) whether psychopathic traits relate differentially to these cognitive processes. Underlying cognitive processes in the IGT were assessed using a mathematical model of the task, the Prospect Valence Learning (PVL) model (Ahn, Busemeyer, Wagenmakers, & Stout, 2008), which has yielded interesting insights into the behaviour in drug-using samples (Fridberg et al., 2010).

Methods

Participants and Procedure

Our original sample consisted of 85 male participants, including 65 volunteers from two Victorian prisons (one maximum, one low- to moderate-level security), and 20 non-offending community controls. Five participants were excluded due to possible moderate to severe head injury, resulting in a total sample of 80 participants (60 prisoners and 20 controls, see Table 1). Participants' ages ranged from 19 to 69 years ($M = 34.23$, $SD = 11.79$). The majority reported European Australian or New Zealand ethnicity (80.1%). Other ethnicities were Asian (5.0%), European (12.5%), North American (1.3%) and Middle Eastern (1.3%). The prisoners' ranged from homicide (23%) to acquisitive offences (e.g., theft). The number of prior convictions ranged from 0 to 263, ($M = 34.9$), prior terms of imprisonment ranged from 0 to 15 years ($M = 2.95$), and current sentence lengths ranged from several months to 30 years ($M = 8.26$ years). Compared with controls a higher proportion of prisoners had histories of drug abuse (36% vs 4%; $F(1,78) = 17.33$, $p = .002$). The groups did not differ in history of alcohol abuse ($F(1,78) = 14.192$, $p = .137$). The prison sample had fewer years of education than controls ($F(1,78) = 4.648$, $p = 0.034$) but did not differ significantly in age or estimated IQ (Wechsler Abbreviated Scale of Intelligence [WASI] 2-subtest version; Wechsler, 1999, see Table 1). There were no significant differences between participants from the different prisons on any of the demographics or PCL:SV variables.

We tested participants individually in a quiet room as part of a larger study, keeping the order of procedures and tasks the same. Monash University Research Ethics Committee and Department of Justice Human Research

Table 1. Participant characteristics.

	Controls ($n = 20$) Mean (*SD*)	Prisoners ($n = 60$) Mean (*SD*)
Age	30 (11.09)	36 (11.81)
WASI 2-subtest IQ	106 (10.49)	99 (14.43)
Years of education *	12 (1.06)	11 (1.94)
PCL:SV scores (Possible range of scores)		Prisoners ($n = 49$) Mean (*SD*)
PCL:SV − Total (0−24)	NA	12 (4.81)
Factor 1 (Interpersonal/Affective) (0−12)	NA	5.2 (3.40)
Factor 2 (Lifestyle/Antisocial) (0−12)	NA	6.76 (3.01)
fct1 − Interpersonal (0−6)	NA	2.43 (2.05)
fct2 − Affective (0−6)	NA	2.78 (1.79)
fct3 − Lifestyle (0−6)	NA	2.82 (1.50)
fct4 − Antisocial (0−6)	NA	3.94 (1.89)

$p < .05$. NA, not available. PCL:SV scores were only recorded for participants who had collateral file information.

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Ethics Committee provided approval for the study, and all participants provided informed consent. Exclusion criteria included reports of illicit drug use in the month prior to assessment, and moderate to severe head injury as assessed by questions from the HELPS brain injury screening tool (Picard, Scarisbrick, & Paluck, 1999). We screened for psychosis using Psychiatric Diagnostic Screening Questionnaire (PDSQ; Zimmerman & Mattia, 2003). Additionally, controls were excluded if they reported a criminal history.

The Psychopathy Checklist: Screening Version (PCL:SV; Hart, Cox, & Hare, 1995)

Psychopathic personality traits were assessed using the Psychopathy Checklist: Screening Version (PCL:SV) by one of the authors (MH) who had been formally qualified through an intensive three-day workshop. Because of time constraints, we used the Screening Version of the PCL, rather than the interview of the full version, which takes up to three hours. The PCL:SV has been validated on forensic and civil samples (Hart et al., 1995) and correlates highly with Hare's (1991) PCLR (Hart et al., 1995). The PCL:SV is a 12-item structured professional judgement based on a semi-structured interview along with collateral information such as a file review. We obtained the collateral information necessary for accurate PCL:SV ratings on only 49 of the 60 prisoners because 11 did not have relevant files for review. We did not have permission to obtain collateral information for our control sample and so did not collect PCL:SV data on controls.

The PCL:SV interview includes topics relating to current and previous lifestyle areas (current status, school history, work experience, career goals, finances, health, family history, friends and intimate relationships, substance abuse and impulsive behaviours, anger control and emotions, antisocial behaviours). From the interview and review of prison files, each participant was rated on the 12 personality traits as 0 (not present), 1 (maybe) or 2 (definitely present). From these ratings, the total score and all factors and facets were computed, by adding the scores of all the traits relevant to each construct. Specifically, fct1−Interpersonal is the combined scores of all the Interpersonal traits (Superficial, Grandiose and Deceitful), fct2−Affective is the combined scores of all affective traits (Lacks Remorse, Lacks Empathy and Doesn't Accept Responsibility), fct3−Lifestyle is the combined scores of all the lifestyle traits (Impulsive, Lacks Goals and Irresponsible), and fct4−Antisocial is the combined scores of all the antisocial traits (Poor Behavioural Control, Adolescent Antisocial Behaviour and Adult Antisocial Behaviour). The fct1−Interpersonal and fct2−Affective traits together form the score for Factor 1, whereas fct3−Lifestyle and fct4−Antisocial form Factor 2. Based on suggested dimensional cut-offs (Hart et al., 1995), 53.1% of our rated sample showed a low level of psychopathy (total scores ≤ 12), 34.7% showed a moderate level of psychopathy (total scores 13−17), and 12.2% showed a strong indication of psychopathy (total scores ≥ 18)

Our intention had been to conduct both facet and trait-level analysis. However, the low incidence of some of the individual psychopathic traits in our sample, and/or the lack of a normal distribution across the three rating levels, limited focus to the facet (groups of similar traits) level. See the Appendix for trait-level analyses (see Table A1 for trait distribution).

Iowa Gambling Task (IGT)

We used a computerized version of the IGT to assess decision-making (see Fig. 1). We used hypothetical rather than real monetary outcomes due to constraints for research within the prison context. Participants were required to make a series of 150 selections (e.g., trials) from four decks of cards. Each choice was associated with winning money, but many choices were also associated with

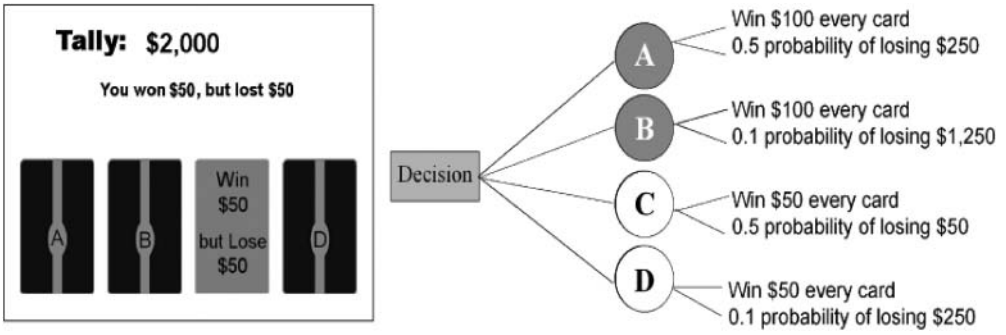

Figure 1. A screen shot and visual depiction of the IGT, with an explanation of the available outcomes. Decks A and B are disadvantageous, because although participants receive $100 each trial they have a higher loss probability. Decks C and D are advantageous, because although they win only $50 each trial they also have a lower loss probability. Note that participants win in each trial, but also frequently lose in the same trial as in the example above where the participant won and lost $50.

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losses; thus the overall value of a selection is a combination of the win and any loss also experienced. Two decks (A and B) are disadvantageous as they are associated with high reward values but also higher loss magnitude, resulting in overall losses. Decks C and D are advantageous as they are associated with lower wins but also lower loss probability (Stout, Busemeyer, Lin, Grant, & Bonson, 2004). Participants began the task with $2000 in "play" money. Bechara, Damasio, Damasio, and Lee (1999)'s instructions were used. Briefly, participants were told to try to win as much money as they could and that some decks may be better than others. They were not given information about the expected amounts or proportions of gain and loss associated with the decks. Total advantageous choices, advantageous choices per 25 selection (blocks), number of cards chosen from each deck, and net outcome (pay-offs) were recorded.

PVL model (Ahn et al., 2008)

To examine how participants learned from their choices across the task, and how wins and losses influenced their choice strategy, we applied the PVL model to the data. The PVL model involves four parameters that are associated with different cognitive components of decision-making. Two parameters are used to define a utility function that describes how individuals weight gains and losses. One parameter controls the shape of the utility function and the other quantifies sensitivity to losses. A third parameter, called the recency parameter, describes how individuals weight past experiences. The final parameter is the choice consistency parameter reflecting the trade-off between explore/exploit behaviour. A full description of the model can be found in Ahn et al. (2008).

Statistical Analyses

To analyse IGT performance, the 150 trials were separated into six blocks of 25 trials each. Because performance improves significantly over the first three trials, and then becomes more even in the latter parts of the task, without significant increases in the final trials (Preston, Buchanan, Stansfield, & Bechara, 2007), we split the trials into learning (first three blocks) and performance (last three blocks) phases. Data were analysed using the statistical programs SPSS v. 19, and Stata v. 11.0.

To determine group and block effects on advantageous IGT choices, we used random effects negative binomial regressions, which is appropriate for count data (Atkins & Gallop,

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2007). The advantage of this approach over analysis of variance (ANOVA) is that it provides incident rate ratios (IRR). IRRs are interpreted similarly to odds ratios; in our study, they indicate the incidence of advantageous choices across trials for one group, and then compare these with another group. Standard regression analyses were used to determine relationships between group and psychopathy variables with overall advantageous choices in the learning and performance phases.

Results

Preliminary Analysis

We first compared controls with prisoners with regard to their IGT performance and found that controls and prisoners did not differ in the number of advantageous choices (IRR = 1.01, $p = 0.81$), and neither group showed significant improvement (e.g., learning) across the task (see Fig. 2). There was also no interaction between group and block (IRR = 0.99, $p = 0.95$). Although we did not find significant learning across the task (IRR = 1.02, $p = 0.99$), significantly more advantageous choices were made on block 6 compared to block 1 (IRR = 0.89, $p = .04$) and block 4 (IRR = 0.89, $p = .03$) (see Fig. 2).

When we examined IGT performance splitting the task into learning (blocks 1−3) and performance (blocks 4−6) components, we found that controls and prisoners were similar in the mean number of advantage choices made on both learning ($F(1, 78) = .246$, $p = .621$) and performance ($F(1, 78) = .378$, $p = .541$) components. None of the demographic variables, including age, education or drug abuse, correlated with IGT learning or performance phases (all p values $> .05$). Prisoners and controls did not differ in terms of PVL parameters.

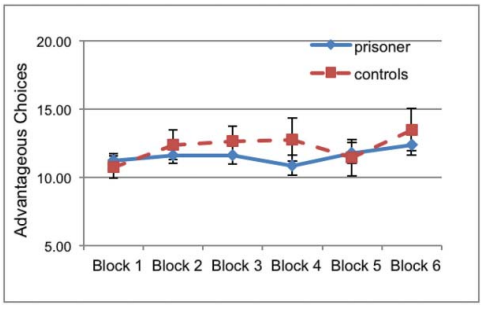

Figure 2. Mean number of advantageous choices made on each block for prisoners and controls.

Relationships Between IGT and Psychopathic Personality Traits

Higher PCL:SV Total Psychopathy scores were correlated with more advantageous choices on the learning ($r = .420$, $p = .003$) but not the performance component of the IGT ($r = .088$, $p = .548$; see Table 2). At the factor and facet level, the learning component was significantly correlated with Factor 1 ($r = .345$, $p = .015$), fct2−Affective ($r = .337$, $p = .018$) and fct4−Antisocial ($r = .375$, $p = .008$). To further examine the learning component of the IGT in relation to aspects of psychopathy, we examined facets from the PCL:SV in relation to learning in the IGT. Regression analyses relating advantageous choices on the learning component of the task to the four facets was significant ($R^2 = .277$, $F(4, 48) = 4.215$, $p = .006$); however, coefficients indicated that only higher scores on fct4−Antisocial were significantly associated with advantageous selections ($\beta = .508$, $t(48) = 3.042$, $p = .004$; Table 3).

To assess how psychopathy related to underlying cognitive mechanisms on the IGT, we applied the PVL model to the IGT data. The PVL model was a better fit for the IGT data than the baseline model, indicated by a mean Bayesian Information Criteria (BIC) statistic of 8.8 ($SD = 21.27$). Thus it was appropriate to examine correlations between PVL parameters (Shape of Utility Function, Loss Aversion, Recency and Consistency) and psychopathy, in order to assess how psychopathy related to underlying cognitive mechanisms in the IGT. All factors and facets were included as our past research has

Table 2. Zero-order correlations for rated sample ($n = 49$) examining relationship between PCL:SV variables and IGT performances.

	Factor 1	Factor 2	fct1	fct2	fct3	fct4	Learning (B1−3)	Performance (B4−6)
Total score	.782**	.705**	.639**	.750**	.547**	.704**	.420**	.088
Factor 1 (Interpersonal/ Affective)		.114	.899**	.866**	.016	.171	.345*	.057
Factor 2 (Lifestyle/ Antisocial)			.004	.211	.873**	.922**	.243	.044
fct1 − Interpersonal				.559**	−.076	.066	.277	.127
fct2 − Affective					.116	.248	.337*	−.038
fct3 − Lifestyle						.616**	.023	−.052
fct4 − Antisocial							.375**	.112

*$p < .05$, **$p < .01$.

indicated that sometimes model parameters have greater levels of sensitivity than performance measures. However, neither total psychopathy nor any of the factors or facets related to the PVL model parameters (all p values $> .05$). Only two significant PVL findings were found at the trait-level (see Appendix).

Discussion

This report is the first to show that high levels on the antisocial facet of psychopathy are related to better performance on the IGT. This finding was significant despite the fact that overall, our prisoner group performed comparably with controls on the IGT. That is, neither group performed well, with both groups showing an absence of learning from experience across the task about what decks had better pay-offs. Previous research has been mixed, showing that high psychopathy is either associated with poorer performance (Blair, Colledge, & Mitchell, 2001; Boulanger et al., 2008; Mitchell, Colledge, Leonard, & Blair, 2002) or is not associated with IGT performance (Blair & Cipolotti, 2000; Losel & Schmucker, 2004; Schmitt et al., 1999). Thus, with our findings added to the mix, the picture remains complicated.

The design of our study to include underlying psychopathic characteristics, and the intriguing association we found between IGT performance and the psychopathic facet of antisociality, leads to another level of possible explanation for the mixed findings. Our

Table 3. Regression analysis investigating which PCL:SV facets in rated sample (n = 49) best predicted advantageous choices during IGT learning trials.

			Correlations		
	Standardized *B*	t	Zero-order	Part	Partial
fct1 − Interpersonal	.121	.768	.277	.115	.098
fct2 − Affective	.179	1.117	.337	.166	.143
fct3 − Lifestyle	−.302	−1.833	.023	−.266	−.235
fct4 − Antisocial	.508	3.042**	.375	.417	.39
R^2	.277**				
Adjusted R^2	.211**				

**$p < .01$.

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findings are evidence that the relationship between psychopathy and IGT performance may differ depending on the underlying facets of psychopathy present in the sample. Thus, given the heterogeneity and complexity of the psychopathy construct, to understand the relationship between decision-making and psychopathy, it may be necessary to examine the underlying psychopathic facets and traits within the particular sample being studied. Further to this question of specificity in relationships between decision-making and psychopathy, we had hoped that modelling the psychological mechanisms contributing to decisions would provide additional resolution to the previous mixed findings, but the lack of significant relationships between model parameters and psychopathy characteristics did not bear out this possibility.

Of all the facets, higher levels of antisocial characteristics (fct4—Antisocial traits) were predictive of better IGT performance. Such a finding is interesting given the debate surrounding whether antisociality is a core component of psychopathy (Cooke, Michie, & Skeem, 2007), with some suggesting it is (Hare & Neumann, 2008, 2010), whereas others suggest it is simply a consequence of the other core psychopathy traits or life experiences (Cooke, Michie, Hart, & Clark, 2004). Given that psychopathy measures also vary in their emphasis on antisociality, a measure that is more adept at capturing antisocial compared with affective characteristics, such as many of the self-report measures, is likely to show different results to some new measures more focused on the affective features.

From a theoretical point of view, our finding that some psychopathic characteristics may predict better (not poorer) choices is consistent with some evolutionary theories, which suggest psychopathy was an alternate evolutionary adaptive strategy (Glenn & Raine, 2009). However, these theories have not been rigorously tested, and have not taken into account differences between specific traits and facets. Nor do neurobiological theories, such as the somatic marker hypothesis (Damasio, 1996). However, neurobiological theories assume higher levels of overall psychopathy would relate to poorer decision-making due to an inability to use bioregulatory signals. Examination of underlying psychopathic characteristics might be the critical issue in clarifying relationships between decision-making and psychopathy, which apart from our results remains relatively unknown.

Examination of facet and trait relationships requires a substantial sample of individuals who vary in the extent to which they display psychopathic characteristics. Relevant here, however, is the fact that relatively few individuals obtain very high psychopathy scores (Hare & Neumann, 2008). The majority of our sample was in a maximum-security prison and therefore included individuals with a range of violent and other serious offences, which we would have thought would yield a more severe sample. A small number of highly psychopathic individuals combined with a large number of traits makes detailed analyses highly complex and low powered. Thus, there are considerable challenges ahead for understanding the relationship between psychopathic characteristics and decision-making. Progress in this area may require broad collaborations that may make it possible to obtain a rich sample of individuals varying in levels of all psychopathic traits and facets.

Understanding how specific psychopathic traits relate to decision styles may benefit treatment and rehabilitation processes if this understanding can be used to tailor the types of treatments to more specific mechanisms that drive decision behaviour in particular individuals. Given the complexity uncovered in the field thus far, however, such a sophisticated approach is currently a long way into the future.

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Appendix

PCL:SV Trait-level Analyses

For the trait-level analysis, the low incidence of some of the psychopathic traits in our sample, and/or the lack of a normal distribution across the three rating levels, necessitated a careful strategy for data analysis. Specifically, all but one trait (Impulsive) had few participants for at least one of the three rating levels. To create sufficient sample sizes for levels of traits that were infrequent at the highest rating levels, for data analysis, we therefore combined the "definitely present" and "maybe" rating levels to form a larger group. This yielded two groups, one in which a trait was definitely not present, and the other in which there was at least some evidence of this trait. Similarly, because of the statistical limitations associated with variability in small sample sizes (Agresti & Finlay, 1997), we excluded from analysis those traits with fewer than 15 participants (30% of the prisoner sample) in either the "definitely present/maybe" or "no" rating levels groups. This resulted in exclusion of five traits (Lacks Remorse, Doesn't Accept Responsibility, Irresponsible, Adolescent Antisocial Behaviour and Adult Antisocial Behaviour) in the trait-level analyses. Seven of the 12 traits (Superficial, Grandiose, Deceitful, Lacks Empathy, Impulsive, Poor Behavioural Controls and Lacks Goals) contained sufficient numbers to examine further (see Table A1).

For the learning component (blocks 1–3) of the IGT, two traits were significantly correlated with performance; Deceitful ($r = .317$, $p = .026$) and Poor Behavioural Controls ($r = .413$, $p = .003$) were related to more advantageous card selections. No traits significantly correlated with the performance component of the IGT.

To assess how specific psychopathic traits related to underlying cognitive mechanisms in the IGT, we examined whether the four IGT model parameters (Shape of Utility Function, Loss Aversion, Recency and Consistency) were correlated with IGT performance. No traits were significantly related to the model parameters, although two trends were noted. The presence of Deceitful tended to relate to less discounting of previous expectancies (Learning Rate parameter $r = .312$, $p = .029$), whereas the presence of Grandiosity tended to relate to higher attention to gains (Utility Function parameter $r = .317$, $p = .026$).

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Table A1. Presence of PCL:SV traits in the rated sample ($n = 49$)

	No (%)	Maybe/Yes (%)
Included traits		
Superficial	51	49
Grandiose	49	51
Deceitful	37	63
Lacks Empathy	63	37
Impulsive	37	63
Poor Behavioural Controls	35	65
Lacks Goals	33	67
Excluded Traits		
Lacks Remorse	22	78
Doesn't Accept Responsibility	18	82
Irresponsible	27	73
Adolescent Antisocial Behaviour	24	76
Adult Antisocial Behaviour	8	92

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